



Collaborations with SDM
and
VisIt and the Joule Metric

Dave Pugmire (ORNL)

www.vacet.org

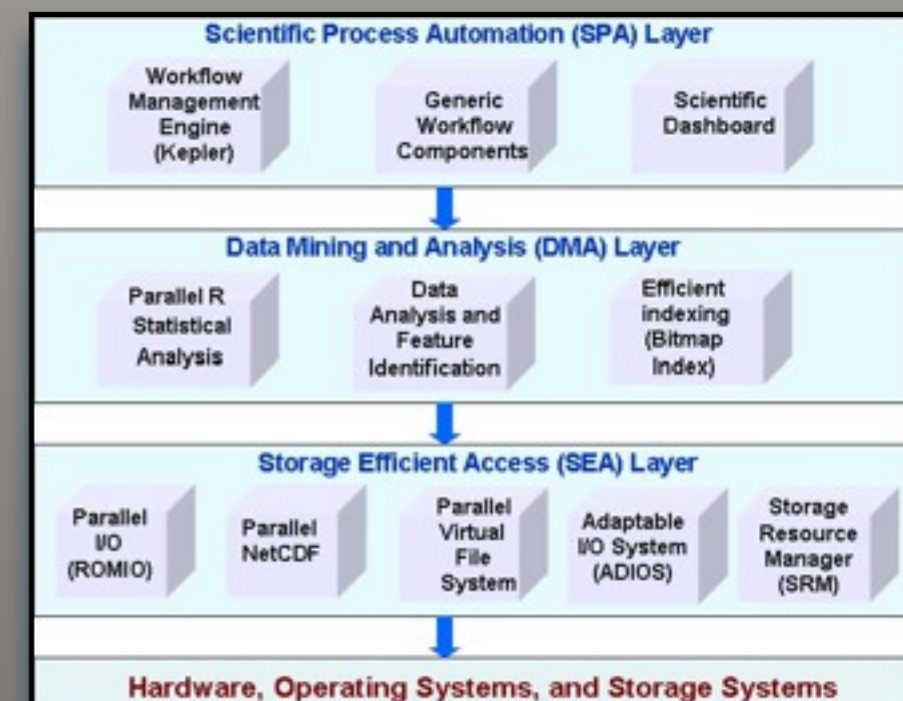
Scientific Data Management Center

- Goal of the SDM Center:



“To help scientists spend more time studying their results and less time managing their data.”

- Focused on work with Astrophysics, Biology, Combustion, and Fusion scientists
- Three tiered approach



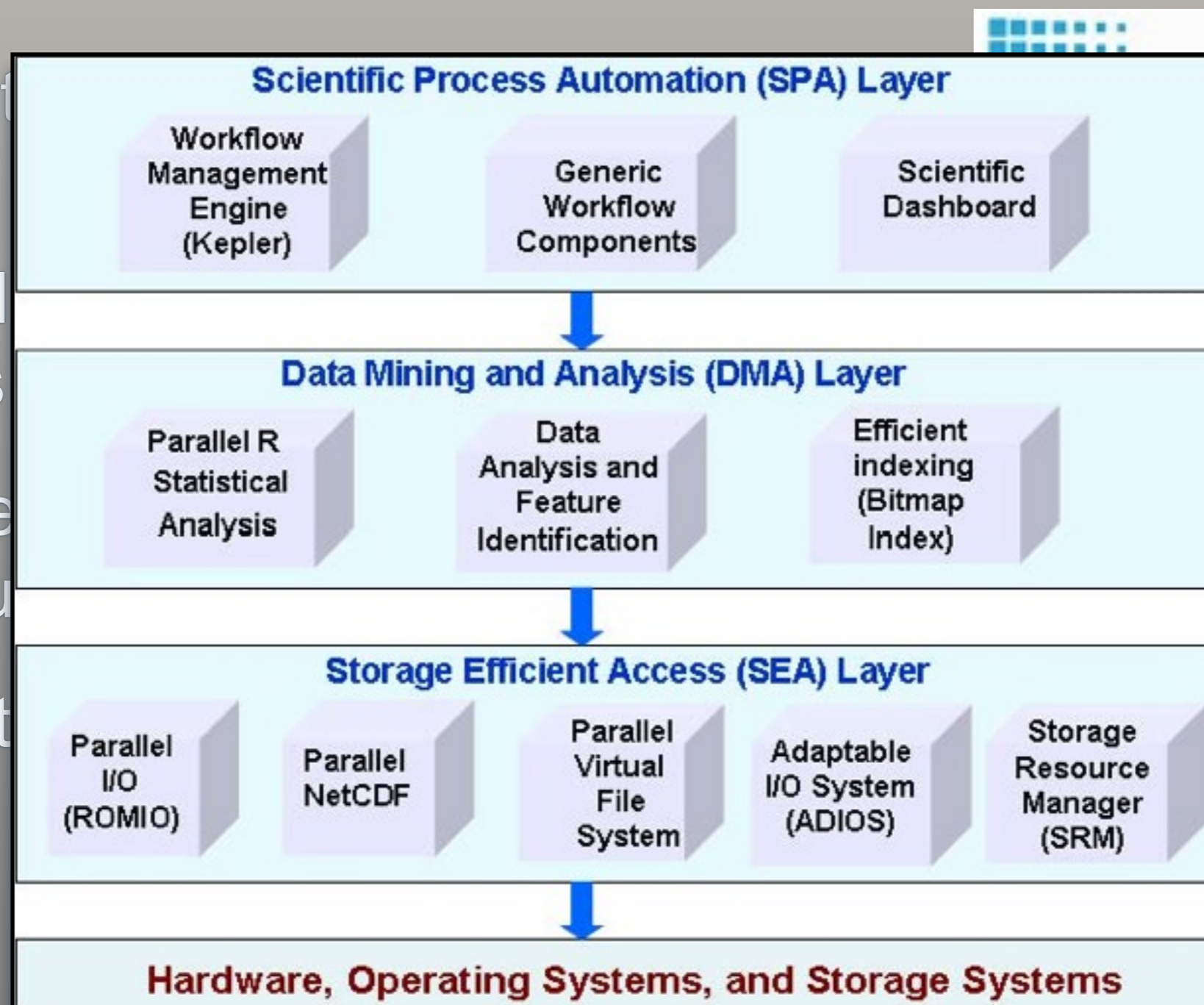
Scientific Data Management Center

- Goal of the center is to help scientists manage their data and results

“To help scientists manage their data and results”

- Focuses on Computational Science

- Three tiers of abstraction



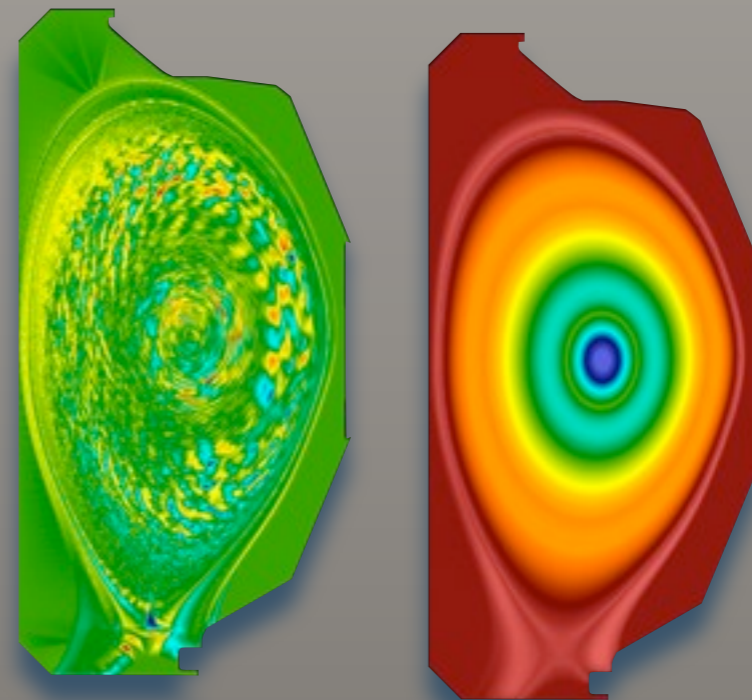
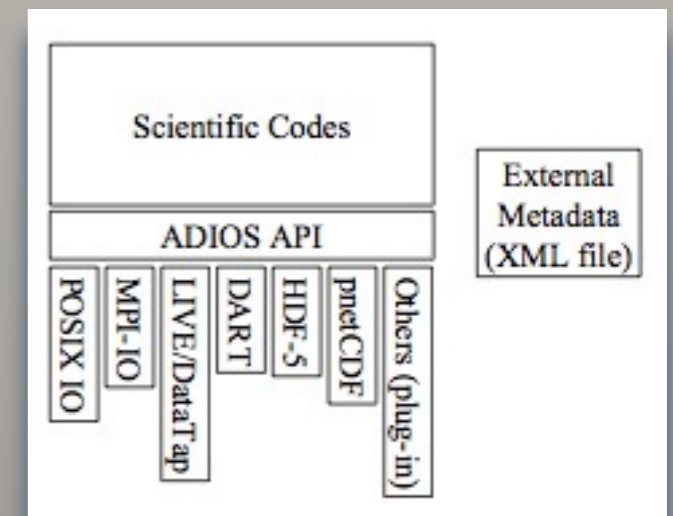
Work with Storage Layer: ADIOS

- ADIOS: **AD**aptable **I/O** file **S**ystem

Middleware I/O package being used in astrophysics, combustion and fusion codes

- Developed a VisIt plugin infrastructure for ADIOS

- Generic, parallel ADIOS reader
- XGC reader
- Pixie reader
- **ADIOS team** developing a CHOMBO reader



Joule metric work highlights

- **What is the problem?**
 - Important ASCR codes may not scale efficiently on today's hardware architectures
- **What did you do?**
 - Analyzed VisIt's parallel performance on representative large datasets on largest ASCR computing resource
 - Tuned VisIt's parallel efficiency for much greater scaling at 10,000+ cores.
- **What was the impact?**
 - Greater ability for data understanding with largest petascale datasets.



The Joule Metric

DOE Office of Science metric for tracking the efficiency of codes on HPC resources

Demonstrate 2x weak scaling by Q4 of a Q2 baseline problem

2009 Joule codes:

The Joule Metric

DOE Office of Science metric for tracking the efficiency of codes on HPC resources

Demonstrate 2x weak scaling by Q4 of a Q2 baseline problem

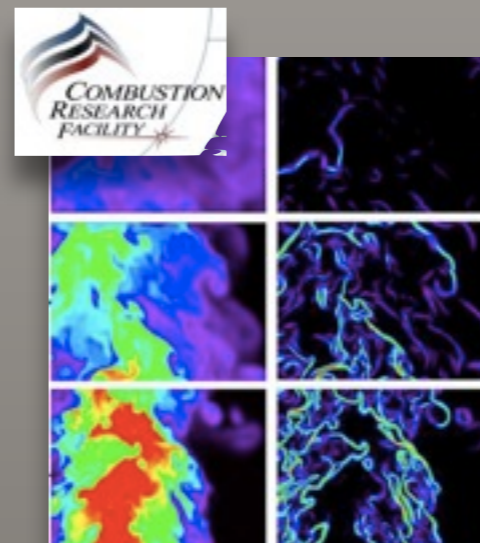
2009 Joule codes:



XGC1



CAM



Raptor



VisIt

Joule Metric Team



Dave Pugmire
ORNL



Sean Ahern
ORNL



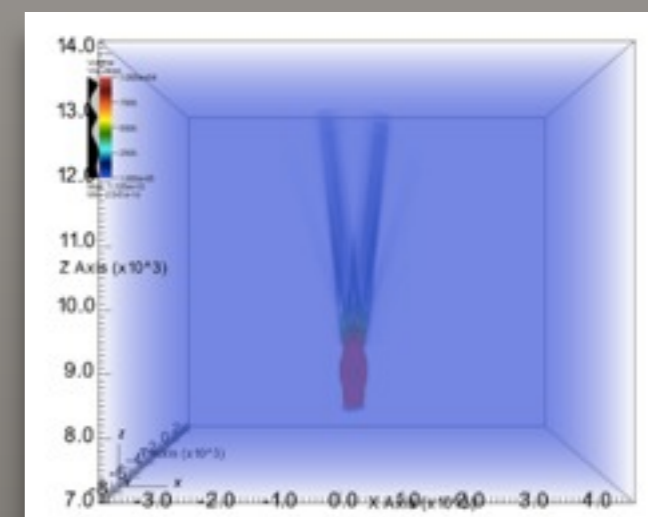
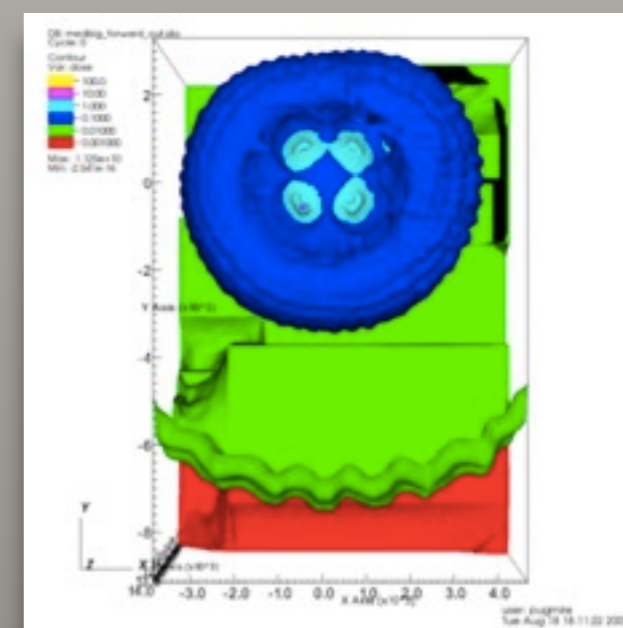
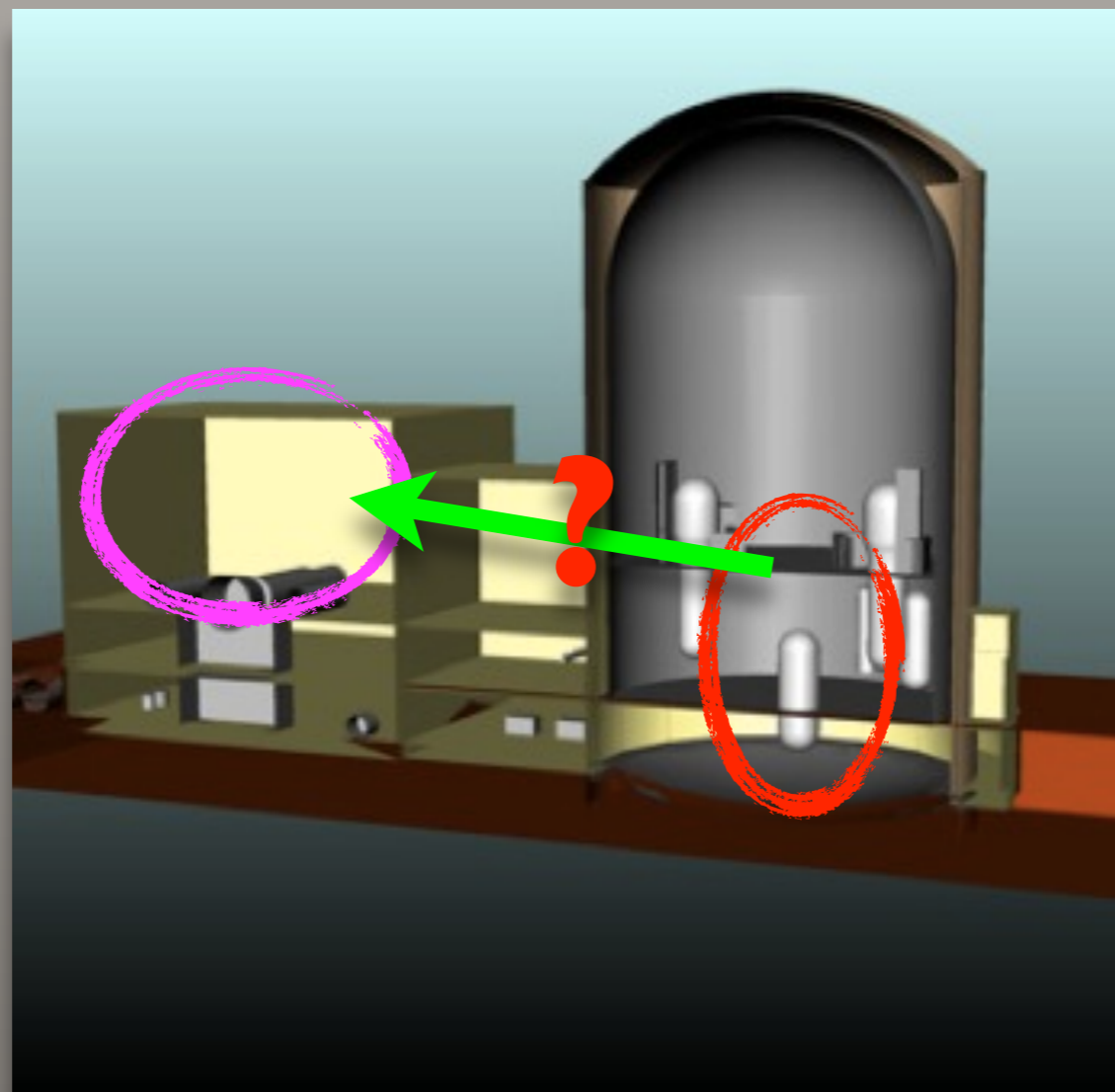
Hank Childs
LBL/UCDavis

Science Stakeholders

Scalability to the data requirements of the future is an infrastructure project critical to most, if not all SciDAC projects

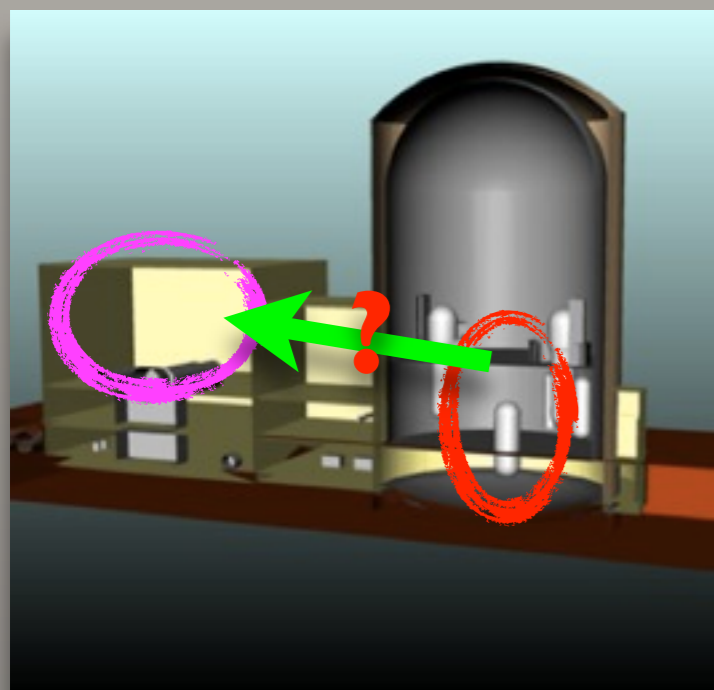
Joule and VisIt

Isocontouring and volume rendering of a radiation transport code, Denovo

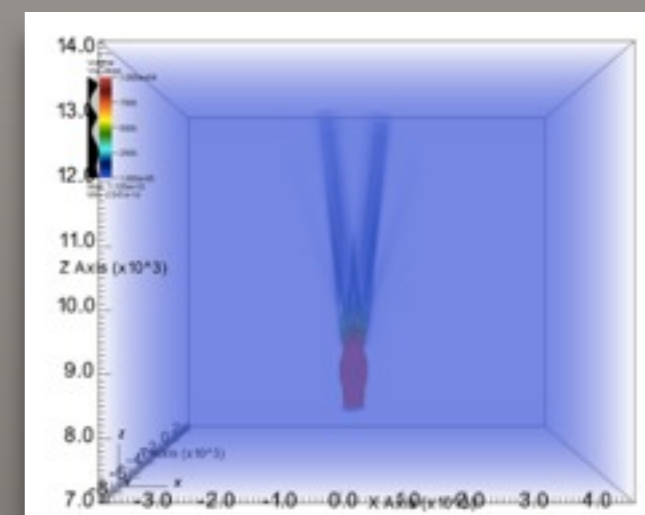
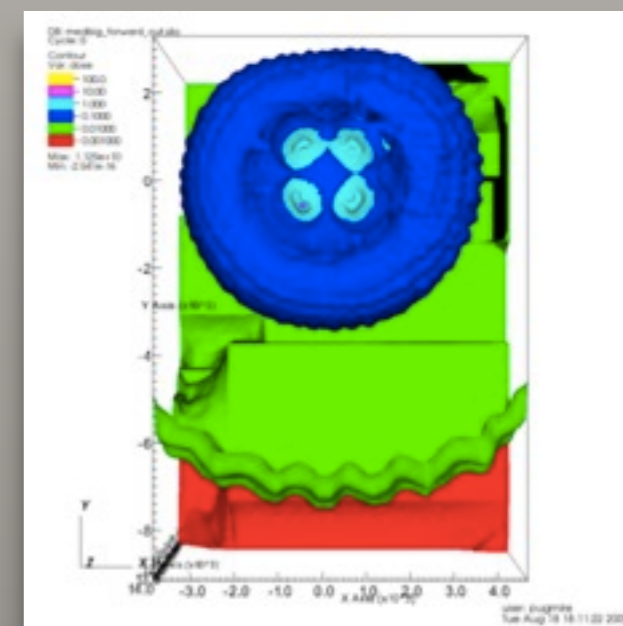


Joule and VisIt

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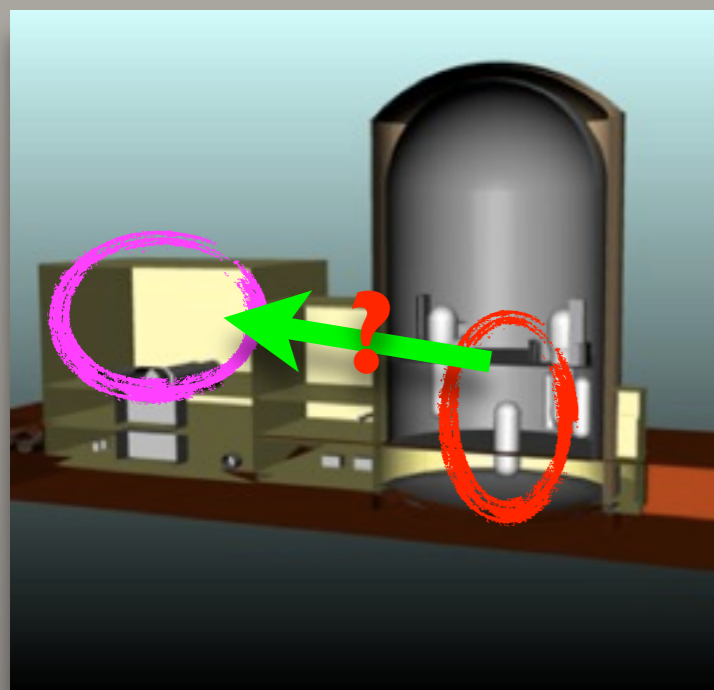


Q2 baseline:
103M cells on 4K cores



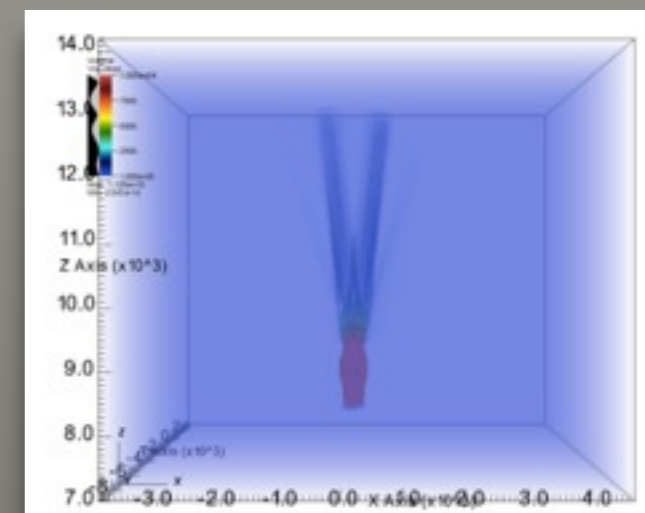
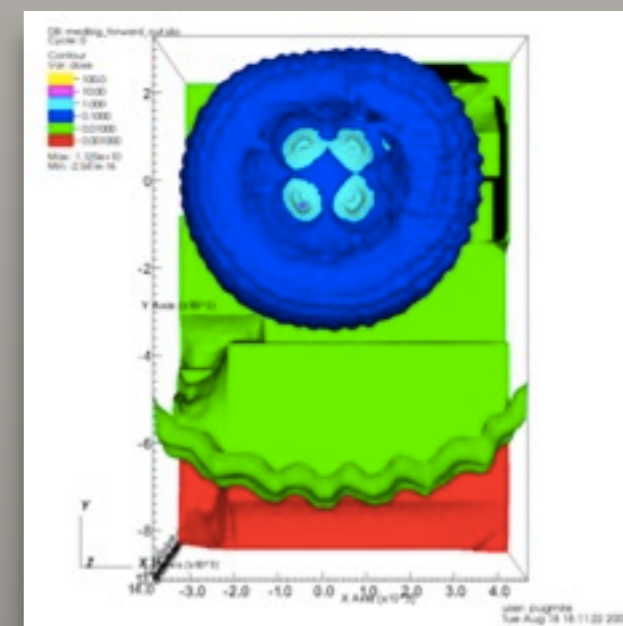
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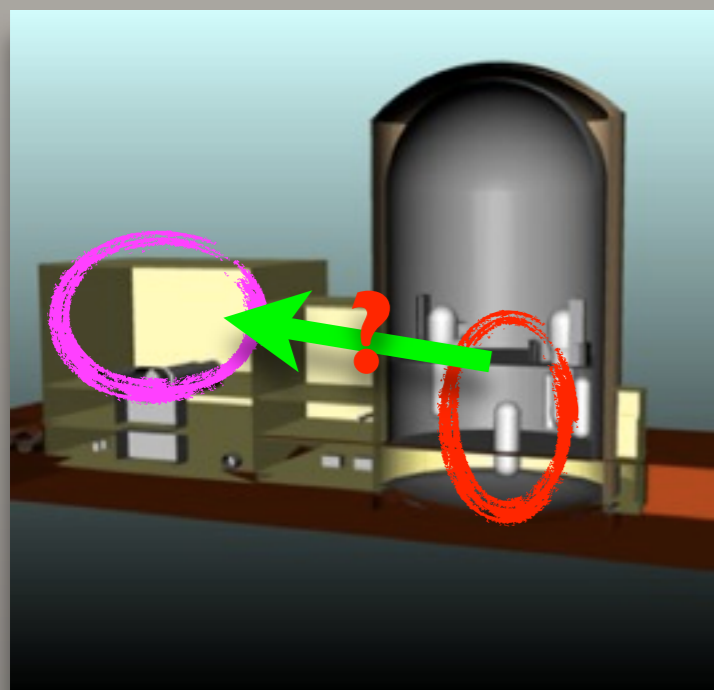
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Q4 benchmark:
321M cells on 12K cores



Joule and VisIt

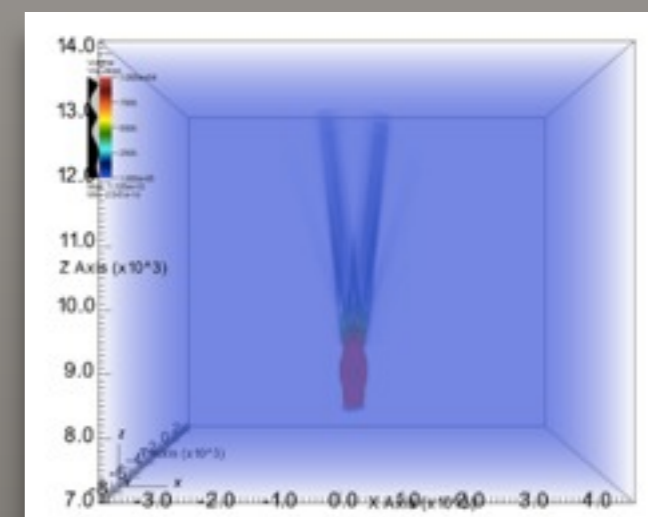
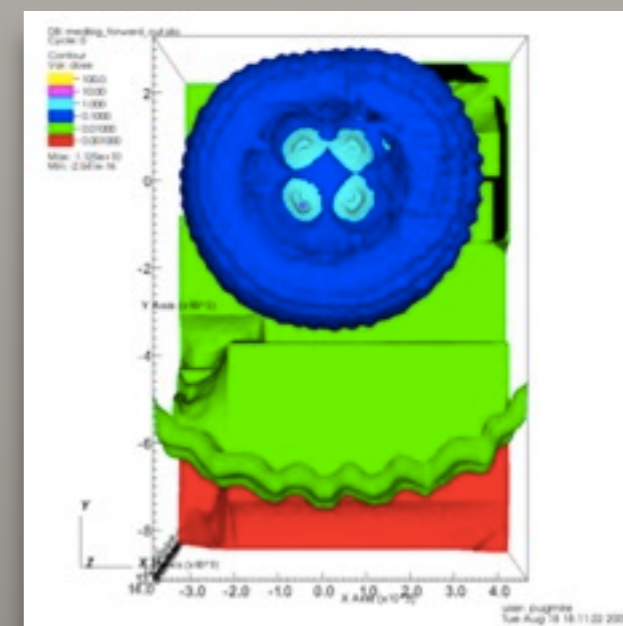
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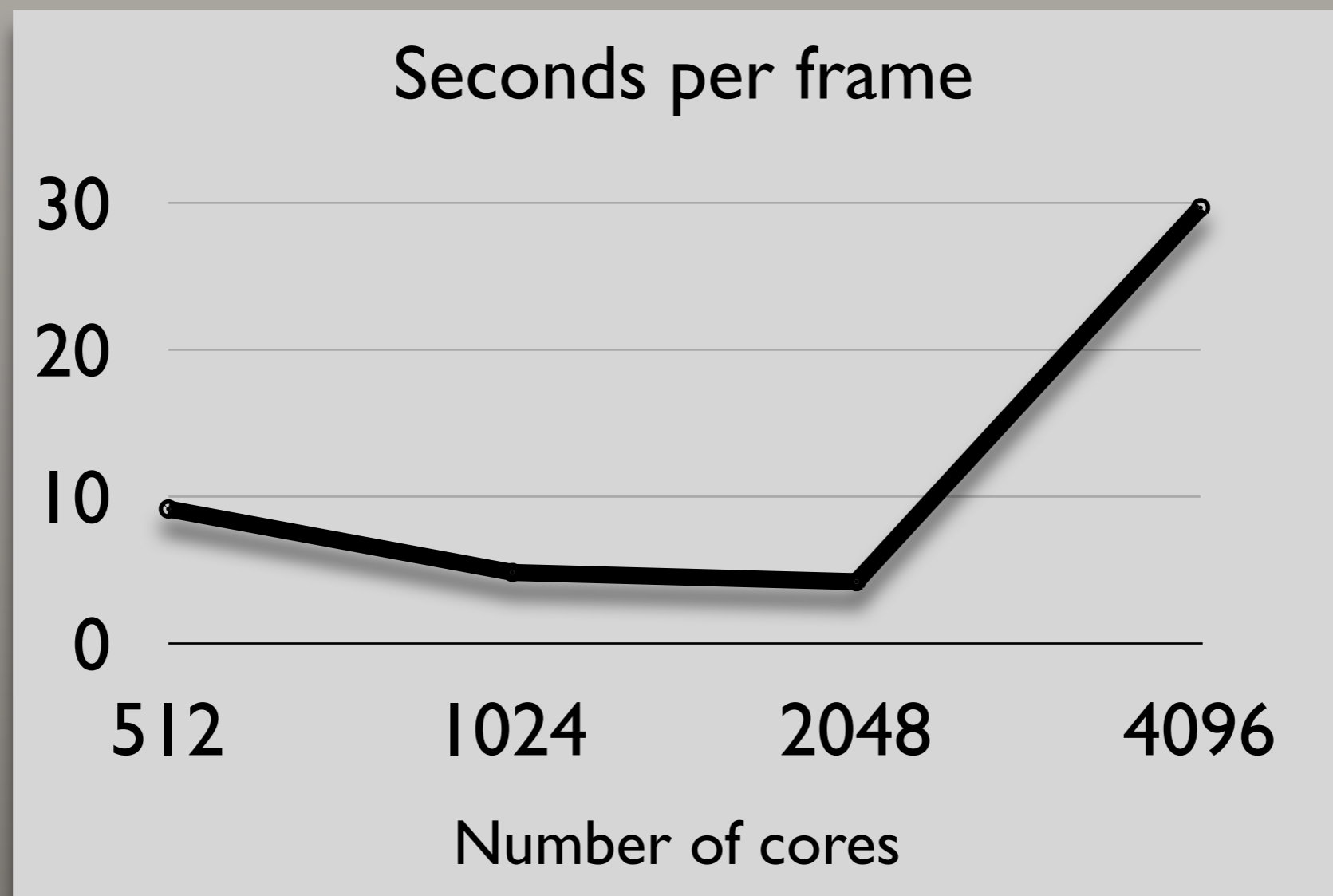
Q4 benchmark:
321M cells on 12K cores

As expected, isocontouring exhibited nearly perfect weak scaling

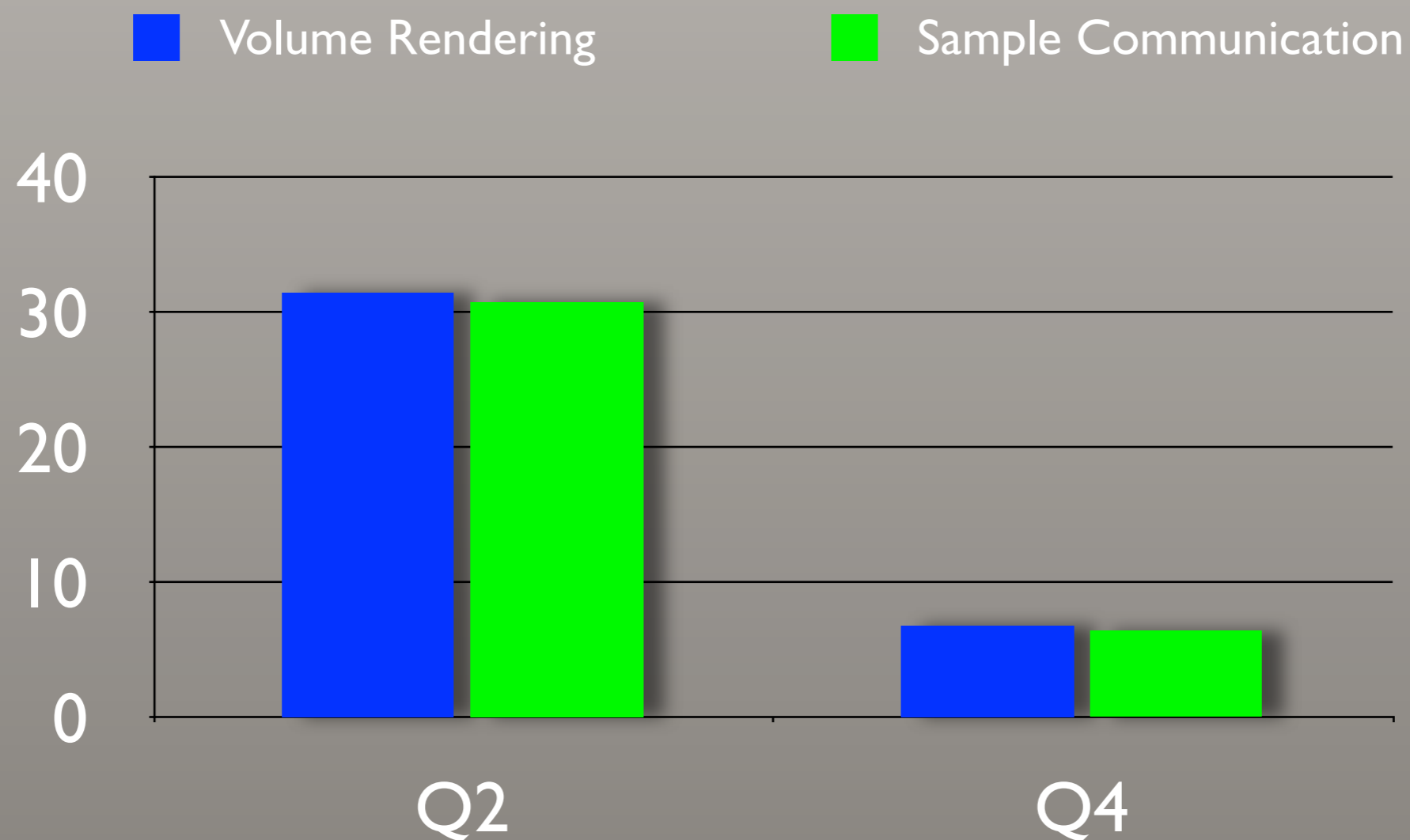


Volume Rendering Scalability

Ray casted volume rendering:
4000 samples per ray, 103M cells
1024x1024 pixel image



Algorithm tuning dramatically improved scalability



Q2 to Q4 weak scaling of **~5X** achieved

Future work

- Project successfully completed!

